Closing the skills gap: an SME's perspective

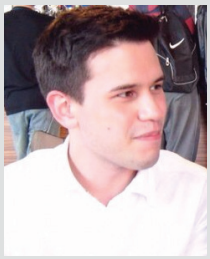
Peter Bryant and **Andy Hicks** report on SR³C Limited's approach to developing its workforce

Authors

Andy Hicks

Andy is a Chartered Physicist and founding Director of SR³C. During his 25+ year career, Andy has led large multi-disciplinary assurance teams supporting both nuclear new build and existing facility projects. He specialises in the management of the safety/design interface and other stakeholder interfaces. Andy has led assurance teams for complex nuclear new build projects at Devonport and Aldermaston during the design and commissioning phases.

Within SR³C, he has the role of Technical Director, providing a focus for technical development. He is currently supporting a large SLC providing experienced assurance leadership across a variety of projects, specifically within the training area.



Peter Bryant

Peter graduated from the University of Bath with a BSc in Physics and University of Surrey with an MSc in Radiation and Environmental Protection. He is a Chartered Physicist (CPhys) and Radiation Protection Professional (CRadP) and Certified Radioactive Waste Adviser.

Peter started his career working on the decommissioning of the Ignalina nuclear power plant before moving into the development of radiation hard semi-conductor neutron detectors at the University of Surrey, and finally nuclear safety and radiation protection consultancy.

He is currently employed by SR³C as a Principal Consultant and additionally acts as the company's Technical and Business Development Manager.

Nuclear new build provides major opportunities for the nuclear supply chain and skilled workforce across the UK. However, the scale of the nuclear new build ambitions, coupled with increasing demand throughout the nuclear fuel cycle and high average age of the existing SQEP (Suitably Qualified and Experienced Person) workforce, has heightened concerns of a wider skills gap. The increasing effects of the skills gap are being seen across the industry with major site licensees reporting up to 80% of their workforce reaching retirement age over the next five years.

In order to ensure the skills gap is appropriately managed and mitigated it is essential that the industry takes action, with all organisations regardless of size having an important role to play. Recognising the skills shortage in the nuclear industry, specifically within the nuclear safety specialism, and the need for small and medium sized enterprises (SMEs) to contribute to the wider nuclear industry, SR³C has committed a significant portion of its turnover to the professional development of its staff. Furthermore the company is supporting universities and external bodies in the development of training courses and industry-focused lectures to ensure the widespread knowledge transfer across industry of our skills and expertise.

The following article provides a summary of SR³C's approach to closing the industry-wide skills gap and summarises the key initiatives the company is fostering. These initiatives include the introduction of a structured professional development scheme, engaging with external bodies and universities and proactively helping clients ensure their staff are provided with the necessary training and skills. It is hoped this will provide useful guidance for SMEs and larger organisations in the supply chain that are embarking on establishing a training and development programme.

Professional development initiatives

SR³C is a multi-disciplinary risk management consultancy providing specialist safety, environmental and engineering services to clients in high hazard industries, in particular the nuclear sector. Recognising the industry skills gap and shortage of SQEP individuals, one of the company's key growth initiatives over the last four years has been the recruitment of a number of junior staff from universities (with a minimum of a technically-based degree, with personnel often at MSc and PhD level) or with two to three years' industrial experience in high technology areas. This recruitment has been a key factor in driving professional development within the company.

Figure 1: *Process used to identify, develop and implement professional development activities*

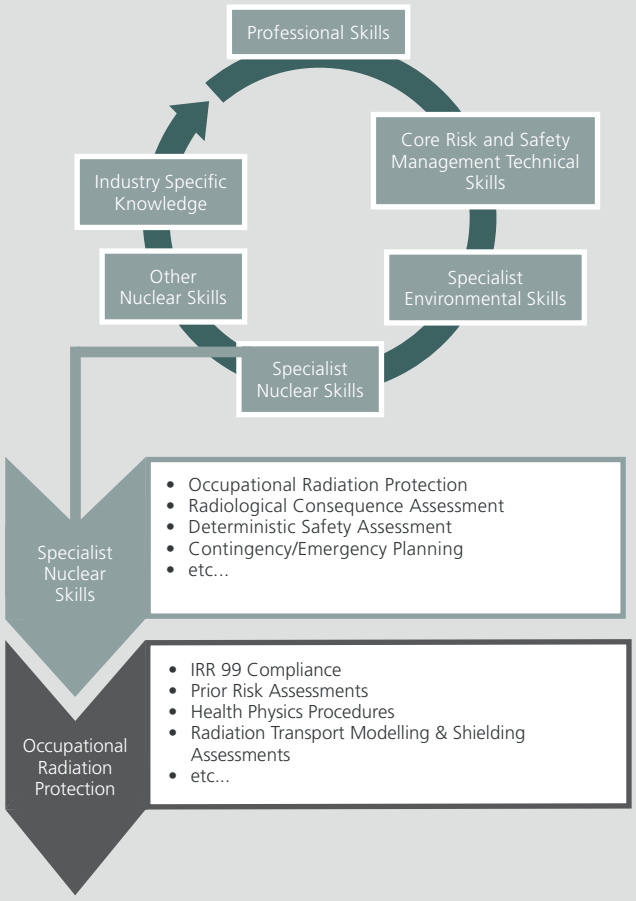


Figure 2: *Overview and 'thin slice' of SR³C's Competency Framework*

> "Following collation of the information across the company, it was possible to take a more holistic view of the professional development requirements within the company"

To support development of personnel, the company has implemented a number of professional development initiatives. These have been derived from an understanding of development needs and consideration of appropriate mechanisms for meeting these needs which came from the (generic) process illustrated in Figure 1.

Elements of this process are discussed in more detail below to provide an overview of SR³C's professional development framework and initiatives.

Development of a Competency Framework

To understand and focus professional development, a Competency Framework needed to be established. Within SR3C this was done by reviewing competencies required to deliver our current services and required input across the business, particularly in specialist areas such as radiological protection. The Framework is structured in a hierarchical manner as illustrated in Figure 2, which provides an overview and a "thin slice" of the Framework to provide an insight into its contents:

This Competency Framework captures technical skills (e.g. design basis accident analysis), knowledge (e.g. understanding of pressurised water reactors) as well as professional skills (such as communication, project management and leadership) which are all essential in the day-to-day work of safety and risk management consultants.

Core risk and safety management technical skills which are broadly applicable to work in all high hazard industries are captured in one element. These skills range from understanding risk concepts / risk management, through hazard and frequency assessment techniques, to safety case management and governance.

The Competency Framework also needed to capture specialist skills, in particular those related to nuclear safety. The company also has specialisms in environmental management, engineering substantiation services, and other specialist skills such as human factors, criticality and explosive risk assessments.

It was recognised that underpinning the Competency Framework, and the specific skills needed to deliver the services, is the technical competence of our personnel as physicists, engineers (electrical, control and instrumentation – EC&I, mechanical), scientists, psychologists etc. This understanding drives support to personnel in the development of technical qualifications, chartership and membership of learned external bodies such as the Institute of Physics and the Safety and Reliability Society.

Overview of an example mentoring module

	Module description / contents	Mentoring resources
Module 2: Risk Management Principles & Safety Cases	• General Risk Management Principles • Risk Concepts / Perception • Occupational risks – Tolerability, Basic Safety Level (BSL) / Basic Safety Objective (BSO), value of life Safety Case Drivers & Guidance: • Why we need Safety Cases (nuclear & other sectors)? • Legislative Drivers • Nuclear specific requirements, e.g. License Conditions, Ionising Radiations Regulations 1999 (IRR99) • Stakeholders • Deterministic & Probabilistic Safety Case approaches Recommended approach: • Place actions for individuals to find out more on above topics prior to start of the mentoring module. • Mentee / mentor dialogue on topics based around SR^{3}C mentoring presentations (See mentoring resources) • Requires 2 x 4 hour mentoring meetings (with equivalent time for research etc.)	SR^{3}C mentoring presentations / hand-outs on: • Risk Concepts • Comparison of Occupational Risks Levels • Risk Perception • Risk Legislation • Risk Tolerability & As Low As Reasonably Practicable (ALARP) • Office for Nuclear Regulation (ONR) Safety Assessment Principles (SAPs) requirements for Safety Cases • Value of Life • Why do we need Safety Cases? • International Atomic Energy Agency (IAEA) Safety Standards Series – Overview • Licence Conditions • Radiation (Emergency Preparedness and Public Information) Regulations (REPPIR) / IRR99 • Safety Case Approval processes Typical reference material: • Haddon Cave Report • Piper Alpha Report • Management of Health & Safety at Work Regulations • ONR SAPs & associated Technical Assessment Guide on safety cases • Health and Safety Executive Tolerability of Risk Report • IAEA Safety Standards

Assessment and development

Once the Competency Framework had been developed, personnel were assessed against the identified competencies. This involved scoring against a set of criteria in order to benchmark each individual's current level of competency and facilitate a more detailed understanding of the professional development needs of each person.

Following collation of the information across the company, it was possible to take a more holistic view of the professional development requirements within the company, while also providing a technical skill profile across the company – giving a baseline for planning future capability developments.

As professional development requirements were identified, consideration was given to the optimum delivery approach to meet these needs. This included a review of relevant training courses/seminars to understand the cost/benefit of outsourcing the training.

For senior personnel within the business, development requirements are primarily met by supporting attendance at industry seminars, conferences and specialist training courses. This is due to the fact that the majority of our senior personnel have in excess of 15-20 years' experience in high hazard industries.

For graduates and less experienced staff, specific consideration was given to achieving an appropriate balance of on-the-job training, mentoring and attendance at training courses. This balance was influenced by the strong history of mentoring by senior personnel within the company, the need to provide support to individuals and build teams within the business, the economics of an SME providing training courses to 10+ personnel and the strong desire to create an enduring capability within the business to facilitate future growth.

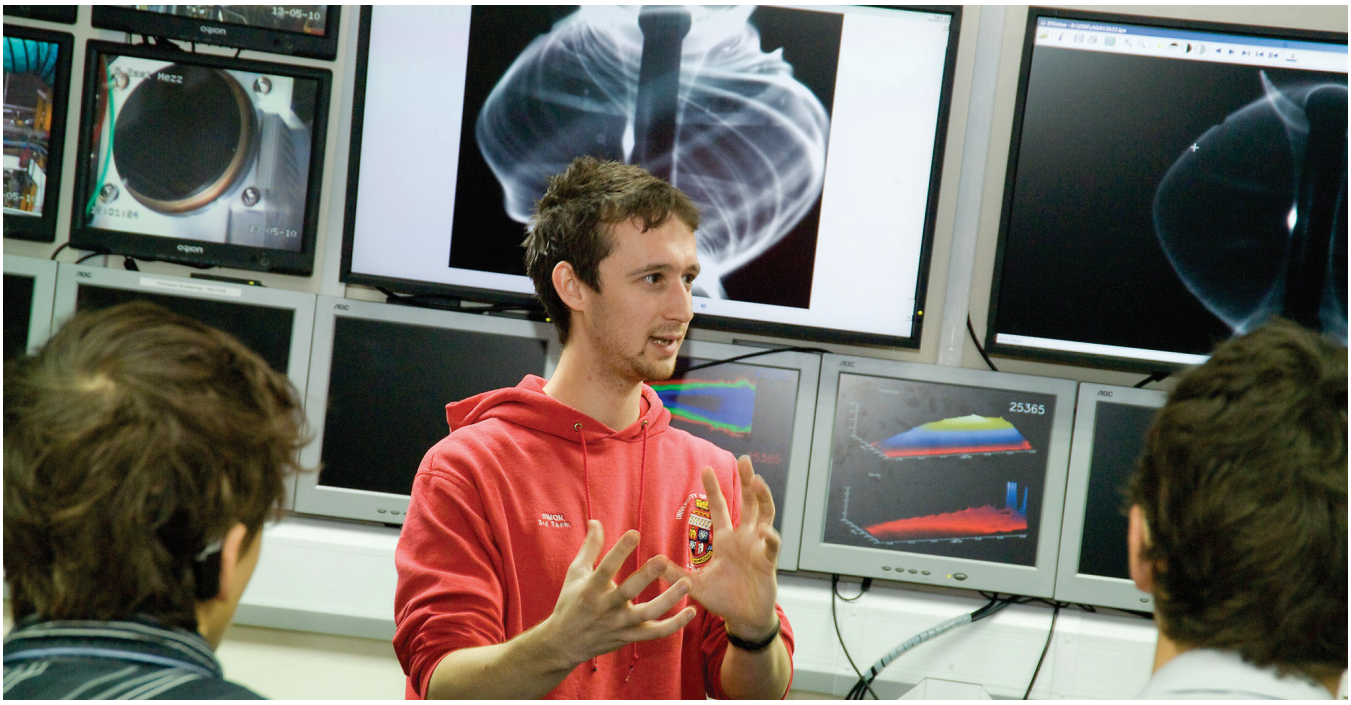
The professional development framework that was derived from these considerations drove initiatives within the business – specifically the production of a structured mentoring and training framework, consisting of internal mentoring resources and training courses, with the commitment to support such initiatives from senior personnel. The aims of this framework are to provide a comprehensive and practical understanding of risk and safety management techniques (in general) and ensure personnel have the ability to deliver all key elements of a nuclear safety case.

Implementation of professional development initiatives

Following the creation of a professional development framework a number of initiatives were derived and implemented across the company. Training and mentoring activities across the business are recorded centrally, assisting in general technical communication across the team. A summary of a selection of these initiatives is provided above.

Technical forums (TFs)

Aimed at all personnel, TFs provide an in-house technical briefing on industry developments and specialist topics highlighted as being of importance / interest to the services provided within the company. They provide a forum for open / constructive dialogue on the topic and generally assist in facilitating technical discussions across the company. The TF initiative is well



established in SR³C and has been supported for the last 6+ years with over 35 TFs undertaken.

TFs are presented by a range of personnel within the company from principal consultants through to recent graduates. For the latter, the TFs provide a supportive environment to develop presentation skills and learn more about topics of interest. Examples of TFs include 'The Role of Testing / Setting to Work / Commissioning in Nuclear Safety Cases', 'Fusion, ITER and Safety' and 'Fukushima Radiological Consequences in Perspective'.

Mentoring framework

The provision of technical support and mentoring is a key part of the development of individuals regardless of level of experience. Within SR³C mentoring is primarily focused at graduates and less experienced individuals within the business, but coaching on specific topics is also available for senior personnel.

Over the last three years the company's mentoring activities for graduates have developed considerably from a relatively ad-hoc / on demand arrangement to a structured set of mentoring modules, underpinned by a wide range of resources. The modules are framed around a relatively complex nuclear safety example which allows the mentees to progress through the design development and nuclear safety case production processes. The example acts as a framework for the mentoring but also provides flexibility to progress / answer topics as they arise, i.e. the mentoring can follow mentee interests and focus on the developmental needs of the group.

The mentoring is delivered by a mentor who is experienced in the technical area and who has the ability to create an open, constructive and stimulating environment. The mentees are typically arranged in groups of three or four (although the modules can be worked through by individuals) with the aim of the group working together, fostering peer teaching within the group. Within the mentoring sessions a variety of learning approaches / techniques are utilised including group discussions (and one-to-ones), presentations led by mentor or mentee, role play, worked examples, brainstorming / problem-solving activities, and individual/ group research on internet and other information sources.

The mentoring modules are supported by various resources and a recommended approach to assist the mentor to deliver. However, it is not necessary to rigidly follow this approach. As such, the mentoring can be modified to focus on the needs of the group. Examples of the mentoring modules include 'Risk Management Principles & Safety Cases', 'Optioneering' and 'Safe Operating Envelope'. An example of the information/resources that are available to mentors is shown below.

It is worth emphasising that the information available for each module is continually developing as different mentoring groups progress through the topics and develop further resources. Favourable feedback has been obtained from the mentees on this mentoring initiative:

"The structure of SR³C mentoring sessions is very open which allows us as trainees to explore areas of study we find most interesting whilst maintaining an overall programme structure to allow us to clearly define where we are developing competency. SR3C mentoring sessions also feel personable as group numbers are kept to a minimum which allows a good level of one to one interaction. Overall, SR³C mentoring sessions have proven to be invaluable to graduates by accelerating our knowledge and providing us with confidence when encountering mentoring topics within the workplace environment." – Ryan Maguire, Josh Smith & Imran Yasin, SR³C Consultants

Development of internal training courses

The cost of buying in established training courses for large numbers of personnel is often high. This coupled with the unavailability of suitable training courses in certain areas has led to the decision by SR³C to develop a number of in-house courses

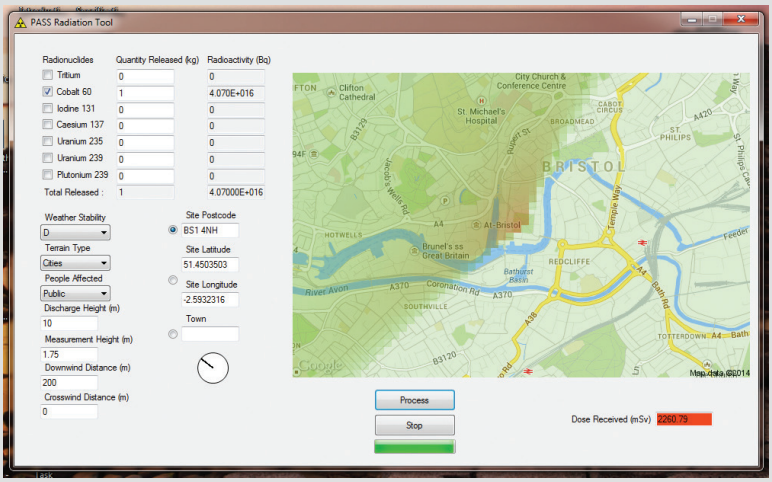


Figure 3: *Hypothetical Release of Cobalt-60 from SR³C's Bristol Office modelled using the PASS Radiation Tool developed by University of Bath Students Peter Barnett, Sven Hollowell, Alex Morrissey and Sam Smillie under the supervision of Peter Bryant (SR³C Limited) and Professor Simon Bending (University of Bath)*

to provide training across the business. Examples range from general "Consultancy Skills Workshops" to technical courses in "Radiological Consequence Assessments" and "Human Factors and its role in a Nuclear Safety Case".

Monitor/Review/Learn/Improve

An integral part of any professional development framework is to monitor/review the mentoring and training and supporting initiatives and to learn/improve. This is particularly important to SR³C as the business, its people and its capabilities are constantly evolving to meet business / client demands. Moreover, as the mentoring and internal course delivery activities progress, further resources are being produced and further improvements identified. This requires the professional development framework to be flexible to cater for continuous learning and improvement. Part of this learning also derives from engagement with external organisations including universities and the Nuclear Skills Academy, and these aspects are further discussed below.

An important part of monitoring is to ensure that all aspects of development support coherently fit together to create a comprehensive training package. A good example of this is with respect to radiological consequence assessment. An SR³C internal course providing a baseline understanding / worked examples was produced and delivered to Graduates in early 2013. Radiological Consequence Assessment was then covered in mentoring, providing reinforcement of the learning and subsequently some personnel have received on-the-job support on more specialist aspects.

Engagement with universities

Over the last few years there has been an increase in universities adapting their courses to help fill the knowledge gaps in the nuclear industry; from longstanding MSc Programmes such as the University of Surrey's MSc in Radiation and Environmental Protection to the introduction of the University of Birmingham's MSc in Nuclear Decommissioning and Waste Management.

SR³C is actively supporting Universities in the development of their courses to not only encourage graduates to enter the nuclear industry, but ensure they are equipped with the necessary knowledge and skills to meet the challenges they will face in their professional careers.

An example of this support includes our ongoing commitment to the University of Bath's Department of Physics Industry Skills module. This third year undergraduate Physics module was devised for students to gain skills in project management, communication skills and teamwork. In addition they would gain a better understanding of the needs of the industry, including time and financial constraints on projects in parallel with developing their technical skills.

"The Industry Skills Module was definitely my favourite module from my university career. It was from this module that I learnt the most, with regards to real world applicable skills. It is as a result of this module that I have learnt more of the nuclear industry and it has led to me looking down this path for a career." – Peter Barnett, Undergraduate Physics Student at the University of Bath

The module runs over 11 weeks and commences with an initial taught element on 'Project Management and Team Work'. Following this, the students are divided into teams of four to six who undertake an industrial team project in response to real-life scientific problems posed by an industrial client. The students use their knowledge of STEM fields to tackle these industry-relevant problems, which typically involve experimental investigation and/or computer modelling.

In addition to providing the taught element of the module, SR3C is currently acting as an industrial client supporting a team of students in the 'Development of a Dose Assessment Tool for Accidental Discharges of Radioactive Aerosols into the Environment'. The aim of the project is to provide the students with an understanding about the fundamentals of atmospheric dispersion modelling of aerosols along with concepts of the dose exposure pathway (i.e. the route of exposure from the source of the aerosols to the intake for a member of the public, such as via inhalation or ingestion of contaminated food products).

The students used this information to develop a 'high level' screening tool for providing an indicative estimate of the dose to members of the public from simple accident scenarios (discharge of a handful of aerosolised radionuclides from the stack of a

building) modelling a number of exposure pathways (inhalation & ingestion) in order to arrive at an estimate of the accrued dose.

"The project work exposed us to an industry we had never heard of, let alone considered pursuing. The work gave me insight into a way of translating theoretical knowledge into a usable end-product. My contribution has sparked my interest in the nuclear field." – Sam Smillie, Undergraduate Physics Student at the University of Bath

The project is currently in its final stages with the developed tool, named PASS (Figure 3), modelling the dispersion of the radioactive particulate using the Gaussian Plume Model. Four exposure pathways are considered when assessing the dose including cloudshine, groundshine, inhalation and ingestion. Significant consideration was given to the usability of the tool and graphical user interface (GUI) to ensure the tool will save time for the user by allowing for easy, rapid and accurate high-end estimation of a release scenario. The tool also provides a graphical representation of the plume on a Google Maps overlay identifying regions where the dose is above the legal limit for the Critical Group being modelled.

Engagement with external bodies

As corporate members of a number of professional bodies including the Nuclear Institute (NI), Safety and Reliability Society and the National Skills Academy Nuclear, SR³C actively encourages its staff to engage with a wide range of external bodies, not only to support their own personal development but for visibility of the industry and to boost knowledge sharing across the industry, ensuring all organisations can learn from each another and ensure best practice across the nuclear sector.

We additionally support and encourage our graduates and consultants to take part in the Nuclear Institute's Young Generation Network (YGN). This has included attending YGN events such as the 'Introduction to Regulation in the Nuclear Industry', the annual YGN Dinner and taking part in national competitions such as the YGN Speaking Competition. The company believes this is an important part of our graduate and consultant professional development as it gives them visibility of industry developments and encourages them to develop their softer skills such as networking.

We understand the importance of engaging with professional bodies to ensure the tools and support are in place to help our staff obtain Chartership. Our chartered staff are engaged with the Institute of Physics (IoP), Institute of Mechanical Engineers (IMechE), Institute of Environmental Management & Assessment (IEMA) and the Society for Radiological Protection (SRP) and are able to act as mentors to our graduates and consultants to provide guidance through their initial professional development. We have additionally worked in partnership with bodies such as the IoP and NI to provide workshops and advice to our staff in completing their chartership applications.

SR³C supports the work being done by the Nuclear Skills Academy (NSA) to develop skills within the nuclear industry. This includes active engagement on current initiatives under the National Nuclear Gateway programme, in particular the Competence Strand which is looking at developing standardised requirements across the industry. One of the initial pilot studies relates to nuclear safety, which strongly aligns with key elements of our company competencies. SR³C has contributed to this Pilot Study by providing NSA with visibility of our Competency Framework; providing a range of personnel to perform a 'self-assessment' against proposed skills (including providing evidence); participated in joint (NSA and SR³C) reviews of competencies and hosting / participating in a structured brainstorm around an example task in order to identify nuclear safety competencies.

Engagement with industry and clients

The design, construction and operation of the new wave of nuclear power stations to be built within the UK coupled with operating and decommissioning of existing power stations nearing the end of their working lives presents a significant challenge to the nuclear industry. Handling the skills gap not only requires effective knowledge transfer from an ageing workforce but the development and encouragement of new ideas and thinking to tackle the future challenges of the industry.

SR³C is currently supporting a number of its clients by seconding senior personnel within site licence companies to complement their existing staff within design authorities / technical authorities ('intelligent customer' roles) and by assisting in the development of new technologies to tackle the future challenges. This includes our ongoing support to Costain which is undertaking a project to develop Tetronics International Ltd's existing plasma vitrification furnace technology into a system for the immobilisation (vitrification) of intermediate level waste in a form suitable for geological disposal. SR³C has been contracted to develop and deliver the preliminary safety report for this technology in order to provide sufficient evidence that the plasma vitrification furnace technology is suitable for use in a nuclear environment. This has allowed our senior staff to apply their existing knowledge and experience to the development of new technologies for the forthcoming challenges of the industry whilst ensuring our junior staff have the knowledge, skills and understanding to support the continuing development and application of these solutions in the future.

The commitment to competency development and training extends beyond the company. SR³C provides experienced personnel to a major Site Licence Company to deliver nuclear safety case training as part of a mutually beneficial initiative to develop / deliver training across the organisations.

A role for all

The article has provided an overview of how an SME can contribute towards closing the industry-wide skills gap including the introduction of structured professional development framework tailored to the needs of the individuals, organisation and industry; engaging with external bodies and universities to encourage knowledge sharing and individuals to enter the industry; and proactively helping clients ensure their staffs are provided with the necessary training and skills to rise to the future challenges of the industry. It is considered that all organisations, regardless of size, have an important role to play in proactively developing individuals not only within their own organisation but the wider industry.